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ABSTRACT

The Rumson-Fair Haven Senior Elective Program was developed and implemented by students, faculty, and administrators over the three-year period from 1971 to 1974. The program offers high school students who complete graduation requirements in the first three years of the four-year program a combination of the following options for the senior year: minicourse electives, independent study, work experience in the community, and preceptorials. The program is conducted in an open space building with an open campus policy. This brochure contains outlines of minicourses in the industrial arts department, listing texts and other bibliographical references and detailing units within the course outlines. Appended to each outline are brief statements on teaching styles and course evaluation methods currently in use in the program. Specific courses listed are Automotive Maintenance, Basic Electricity, Jewelry, Advanced Jewelry, and Lapidary. (Author/PGD)

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COURSE OUTLINES IN INDUSTRIAL ARTS

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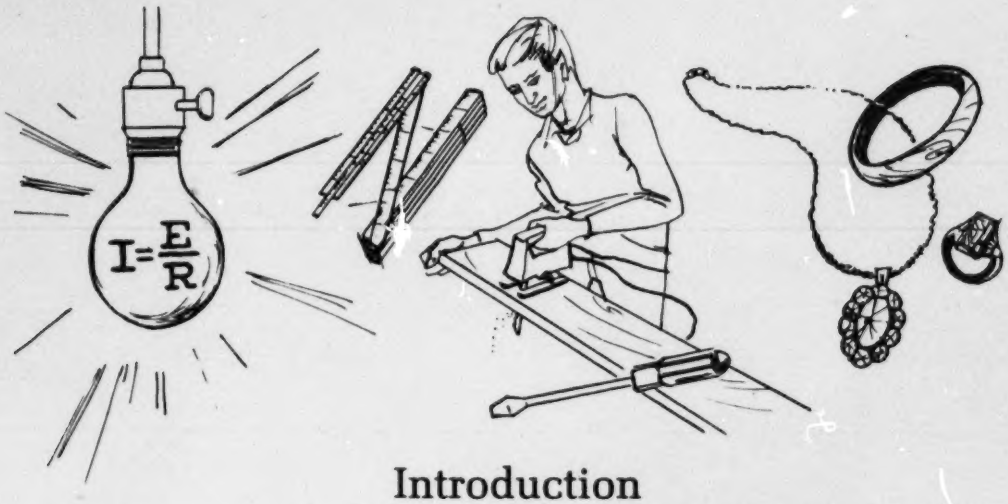


Introduction

The Rumson-Fair Haven Regional High School Senior Elective Program was developed and implemented by students, faculty and administrators over a three year period from 1971 to 1974. In 1974 it was validated by the standards and guidelines of the United States Office of Education as successful, cost-effective, and exportable and approved for national dissemination by the Dissemination Review Panel. Funding for the development as well as the dissemination was through the Elementary and Secondary Act, Title III program in New Jersey.

Brochures describing the Senior Elective Program are available to interested parties free of charge. Visits to the Rumson-Fair Haven Regional School to see the program may be arranged with the project director. Interested educators may purchase a filmstrip-cassette presentation describing the development and implementation process, and a Resource Compendium and Profile containing student and teacher reactions to the program as well as outlines of seventy-six mini-courses developed by the staff.

The Rumson-Fair Haven Senior Elective Program offers high school students who complete graduation requirements in three years a combination of the following options for the senior year: mini-course electives, independent study and preceptorials. The senior program is conducted in an open space building. An open campus policy for seniors allows them to follow highly flexible schedules based upon a modular scheduling procedure. Funding by ESEA Title III provided stipends for planning and writing mini-courses of study covering a wide variety of subjects. Some of them may be considered as units of larger year long subjects, some are "new" to most secondary school curricula, while still others cross over departmental lines.

This brochure contains fully developed outlines of courses in the Industrial Arts Department listing texts, other bibliographical references, and detailed units within the course outlines. Appended to each outline are brief statements on teaching styles and course evaluations currently in use for each course. It should be noted that these courses are now being presented by the staff at Rumson-Fair Haven Regional High School. Complete outlines for other departments are anticipated in later publications.

Mr. Harry Carter
Chairman

ADVANCED JEWELRY

by Frank Azzaro

OBJECTIVES

This course provides an opportunity for students to continue their investigation of jewelry-making beyond the basic Jewelry-Lapidary course. Several new techniques and processes are introduced. Some procedures from the basic jewelry course are explored in depth, but designs are more complex and techniques more sophisticated. Craftsmanship is stressed and commercial processes and occupational opportunities are investigated. The basic Jewelry-Lapidary course is a prerequisite for enrollment. The following topics are considered:

PART I. COURSE OUTLINE

I. Development of Basic Processes

A. Wrought-forming
   1. Cutting operations
      a. Jeweler's saw
      b. Files
      c. Pliers
      d. Snips
      e. Grinders
      f. Shears
      g. Piercing tools
   2. Forming metals
      a. Forging
      b. Bending
      c. Drawing
      d. Plainishing
   3. Texturing surfaces
      a. Matting
      b. Chasing
      c. Filing
      d. Engraving
   4. Polishing
      a. Abrasive cloth
      b. Buffing compounds
         (1) Tripoli
         (2) White diamond
         (3) Jeweler's rouge
      c. Buffing wheels
      d. Burnishing
      e. Trimming

B. Centrifugal and cuttlefish bone casting
   1. Centrifugal process
      The process is described and demonstrated to the class. The steps include setting up a centrifugal caster, balancing it with an invested flask and a proper amount of silver in a crucible; the flask is then placed in a burnout kiln for approximately four hours. The flask is removed from the kiln and placed in the caster, the casting arm is wound two and one half turns, and borax is added to the metal. When the molten state of the metal is reached, the casting arm is released, the hot flask is quenched in water, and the piece is removed. It is ready for finishing.
   2. Cuttlefish bone casting
      After a brief description, the process is demonstrated to the class. A cuttle bone and a model to be used for the impression are selected. The cuttle bone is cut in half. Both sections are sanded flat with sandpaper, and model and guide pins are pressed into one section. The second section is placed over the first and the palms of the hands are used to force the sections together. The model is then removed and spruer vents and funnels are cut into the section. The sections are now blown out and checked for faults. Both halves are wired together and placed in a pumice tray. Metal is then melted in a crucible, borax is added, and the metal is poured into the mold. It is allowed to cool, and is quenched. Later the piece is finished.

C. Joining (hard and soft soldering)
   1. Hard soldering
      a. Materials
         (1) Solder
         (2) Flux
         (3) Asbestos block
         (4) Torch
         (5) Poker
      b. Melting temperatures of metal — discussion
         (1) Gold
         (2) Fine silver
         (3) Sterling silver
      c. Procedure
         (1) Fitting
         (2) Cleaning
         (3) Fluxing
         (4) Solder placement
         (5) Heating
   2. Soft soldering
      a. Material
         (1) Solder
         (2) Flux
         (3) Asbestos block
         (4) Torch
      b. Procedure
         (1) Fitting
         (2) Cleaning
         (3) Fluxing
         (4) Soldering
         (5) Heating

D. Finishing and setting stones
   1. Finishing stones

a. Selection
b. Slabbing
c. Trimming
d. Dopping
e. Rough grinding
1) Cabochon cut
2) Faceted cut
f. Fine grinding
g. Polishing
1) Cerium oxide
2) Diamond pounder

2. Settings
a. Bezel
b. Reverse bezel
c. Paved
d. Gypsy
e. Wire caging

II. Introduction of New Processes

A. Electroplating
1. Material
a. Gold, silver, copper, anode
b. Model (cathode)
c. Plating solution (electrolyte)
d. Cleaning solution
e. Pyrex beaker
f. D.C. power source
g. Heat source

2. Electroplating process
The electroplating process is first discussed and then demonstrated to the students. The first step is to clean a model of all foreign matter. A copper wire is attached to the model, and it is dipped into a heated cleaning solution, and then rinsed with water. Then it is dipped into an electrolyte for a desired time and with proper amperage, rinsed with water and buffed lightly to a finish.

B. Investment Casting (lost wax)
1. Material
a. Wax (various melting temperatures)
b. Modeling tools
c. Alcohol lamp
d. Investment plaster
e. Flask and base
f. Vibrator
g. Debubbling solution
h. Sprue wire
i. Burnout oven
j. Casting machine

2. Lost wax process
The process is described and then discussed with the class. The steps include forming a model and sprueing it to a base using eight gauge wax wire. The model is coated with debubbler and is allowed to dry. A flask is placed over the model and on top of the base. Investment plaster is mixed and poured into the flask which is placed on top of a vibrator for one minute. The investment must then dry for one hour. It is placed in a burnout oven for approximately four hours, fired to 1,200 F., and removed and placed in a caster cradle. Metal is melted, borax added and the caster arm is then released for metal delivery. The flask is then quenched in water and the piece is later finished.

C. Steam Casting
1. Material
a. Wax (various melting temperatures)
b. Modeling tools
c. Alcohol lamp
d. Investment plaster
e. Flask and base
f. Vibrator
g. Debubbling solution
h. Sprue wire
i. Burnout oven
j. Casting machine

2. Steam casting process
After a brief description the process is demonstrated to the class. A model is formed and sprued to a base with 13 gauge wax wire. The model is coated with debubbler and allowed to dry. A flask is placed over the base and mixed investment plaster is poured into flask. It is placed on a vibrator for one minute. The plaster is allowed to dry for one hour. The sprue base is removed and concave cuts are hollowed into the flask. It is then placed into burnout oven for approximately four hours, fired gradually to 1,200 F., and removed and placed on a workbench. An appropriate amount of metal is put into the concave areas of the flask, the metal is heated with a torch and borax is added to the molten metal. A water-dampened asbestos plunger is securely placed over the flask and steam pressure is delivered. The flask is quenched in water, and the piece is removed ready for finishing.

D. Pattern-making
1. Types of design
a. Functional
b. Experimental

2. Graphic representation
a. Sketches
b. Models

3. Design transfer
a. Scribe
b. Paper pattern and glue
c. Carbon paper (tracing)

PART II. RESOURCES AND EVALUATION

A. Text

The Design and Creation of Jewelry, (1st ed), Van Neuman, Robert, Chilton Co., Book Division, Radnor, Pa., 1961.

B. Additional Readings

Jewelry Making for Schools, Tradesmen, and Craftsmen, Bovin, Murray, Bovin Pub., Forest Hills, N.Y., 1964.

Creative Casting, Choate, Sharr, Crown Publishers, 1966.

How to Make Modern Jewelry, Martin, Charles, Museum of Modern Art, Simon and Schuster, N.Y., N.Y., 1949.

Practical Enameling and Jewelry Work, Newble, Brian, Viking Press, N.Y., N.Y., 1967.

Modern Jewelry, Design and Technique, Brynner, Irena, Reinhold Book Corp., 1963.

Ideas for Jewelry, Davidson, Ian, Watson-Guptill Pub., N.Y., N.Y., 1973.

C. Periodicals

Lapidary Journal
Modern Jewelry
Craft Horizon
Rock & Gem
Gems & Minerals
Rock — Hound
Agate of North America
Jewelry Keystone Circular

D. Teaching Styles

This course can accommodate 10-15 students working in an open lab situation. Most instruction is on an individual or small group basis with students sharing information and helping one another. Commercial supply houses are investigated for students wishing to pursue jewelry-making on an independent basis.

E. Evaluation

Pass-Fail grades are given based on attendance, participation, individual accomplishment and the satisfactory completion of the two required pieces.

PART III. DETAILED UNIT

I. Creating, Casting and Finishing (lost wax process)

A. Creating pattern (wax)
   1. Additive method
      a. Building up low areas
      b. Increasing surface texture
   2. Subtractive method
      a. Removing surface areas
      b. Removing sections completely
   3. Free form
      a. Dropping in hot water
      b. Reworking with modeling tools

B. Lost wax process (see Part I, II — B 2 for explanation)

C. Finishing
   1. Place in v-slat and use saw to remove buttons, sprues and vents
   2. Heat work to dull red and quench in hot pickling solution (annealing)
   3. Rinse in water
   4. File remaining imperfections from work — scotch stone can be used for marks in hard-to-get areas; or flexible shaft grinder may also be used
   5. Polish with buffing wheel and rouge
      a. Bobbing
      b. Tripoli
      c. Rouge
   6. Wipe with polishing cloth

II. Resources for Unit on Casting

Lost Wax: The New Modern Craft, 2nd ed., Romulus, C., Kerr Manufacturing Co., 1971.

Centrifugal Lost Wax Jewelry for Schools, Tradesmen and Craftsmen, Bovin, Murray, Bovin Publishers, Forest Hills, N.Y., 1971.

AUTOMOTIVE MAINTENANCE FOR SENIOR BOYS AND GIRLS

by William Frazee

OBJECTIVES

This course has been prepared in recognition of the fact that the automobile has become an integral part of daily life in this country; that it represents a major expense; and that the average automobile owner or driver has a vague knowledge regarding the economical maintenance as well as the operation of his car.

The course is designed for students who wish to service and repair their own cars or become familiar enough with them so as to diagnose problems and communicate intelligently with a mechanic. Students learn to perform service station operations on cars ranging from changing tires and oil to simple brake jobs and tune-ups.

Course Objectives:

1. Informing students on the periodic maintenance required for an automobile to operate efficiently and economically
2. Teaching them to interpret advertising matter in order to further consumer knowledge
3. Familiarizing students with names and parts of an automobile and their location
4. Surveying the market in products and service
5. Teaching simple theory as an aid to localizing automotive troubles

6. Acquiring the techniques of making simple adjustments and repairs
7. Recognizing incipient trouble
8. Learning how to purchase a car, new or used

PART I. COURSE OUTLINE

I. Familiarization and Theory

Nomenclature followed by a discussion of use for each unit. Live automobiles, mock-ups, and drawings are used. The theory of internal combustions is presented through commercial movies available from manufacturers such as General Motors.

A. Chassis and Body
   1. Frame
   2. Body and body supports
   3. Compartments
      a. Engine
      b. Passenger
      c. Trunk

B. Suspension, Wheels and Tires
   1. Rear springs & shock absorbers
   2. Front springs & shock absorbers
   3. Front end alignment
      a. Caster
      b. Camber
      c. Toe-in
   4. Tires
      a. Inflation
      b. Normal and abnormal wear
      c. Quality and special tires

C. Steering System
   1. Steering wheel and column
   2. Steering parts and location

D. Lubrication Points

E. Brakes & brake light switches

F. Exhaust System, location & usage

G. Electrical System, parts & sub-systems

H. Power train

I. Fuel System from tank to engine

II. Mechanical Safety and Inspection

An examination of and a discussion on the parts of an automobile with particular emphasis on safety and state inspection

A. Exhaust system

B. Tires
   1. Wear and causes of wear
      a. The effects of unbalanced wheels
      b. The effect of misalignment
      c. How to check for wear
   2. Tires as a part of steering
      a. Inflation
      b. Wear patterns on front tires

C. Lights, intensity & focus
   1. Light output
   2. Checking for burned out lamps
   3. Fuse locations and sizes
   4. Loose connections

D. Brakes
   1. Normal wear and adjustment
   2. Master cylinder and fluid level
   3. Checking for leaks

III. Periodic Service

The need for proper service to avoid abnormal wear, according to mileage and season, are discussed. This includes a periodic motor tune up which should be done on a regular basis depending upon the type of driving and car usage. (See attached detailed unit)

IV. Reading Advertising Material

Facts are often obscured in selling claims and features. Many stated specifications need clarification to assay their value.

A. Reading and understanding new automobile ads with specifications

B. Reading product ads for information

V. Buying a Used Car

(The responsibility for purchase lies with the buyer)

A. Establishing transportation needs

B. Deciding on make and model

C. Examining for wear

D. Listening to the engine

E. Test driving for performance and noises or vibrations

F. Requiring guarantee and passing inspection

G. Financing

VI. Survey of Accessory Products

A. Additives
   1. Gasoline additives
   2. Oil additives
   3. Additives for radiator, battery and transmission

B. Special purpose products
   1. To avoid repair
   2. To improve performance

C. Finishes
   1. Waxes and polish
   2. Chrome cleaners
   3. Washing materials

D. Protective materials and products
   1. Seat covers
   2. Mats
   3. Other materials

VII. Common Auto Problems and Trouble Shooting

This unit represents the activity of the course and runs concurrently with the demonstrations and the discussions in other units. Extensive reference is made to standard works on trouble shooting, such as Motors Manual or manufacturers' repair manuals.

A. Car won't start
   1. Refer to manual for possibilities
   2. Make simple tests as indicated

B. Windshield wiper doesn't wipe clean — consult manual and make necessary repairs
C. Learning to make simple tests
   1. Test for spark
   2. Test for fuel
   3. Test for fuses and burned out lamps
D. Making minor adjustments
   1. Fan belt
   2. Door striker
   3. Idling speed and mixture

VIII. Buying a New Automobile
A. Establishing needs, price range, size
B. Considering maintenance costs for several makes and models within means
C. Considering color from different points of view
D. Considering operating cost for same makes and models within needs
E. Investigating probable weak points
F. Determining resale value of those cars you are considering
G. Investigating insurance rates for cars under consideration
H. Talking to competent repair mechanics
I. Obtaining factual specifications
J. Examining payment plans offered by many agencies
K. Deciding and choosing
L. Inspections by competent mechanics
M. Returning to dealer for necessary work before making payment
N. Following manufacturer's recommendations on service and break-in

PART II. RESOURCES AND EVALUATION

A. Text
Automotive Mechanics, Crouse, W.H., McGraw Hill, N.Y., N.Y., 1956.

The text is planned for this course. Information will be presented on information sheets prepared by the teacher. Considerable use will be made of manufacturers' shop manuals and compiled works such as Motors Repair Manual.

B. Additional Readings
Know Your Car, Allen, W.A., American Technical Society, Chicago, Ill., 1960.

Understanding Your Car, Beeler, S.C., McKnight & McKnight, Bloomington, Ill., 1958.

Automotive Fundamentals, Frazee, I. and Bedell, Earl, American Technical Society, 1949, Third Edition, Chicago, Ill., 1956.

All About Small Gas Engines, Purvio, Jud, Goodheart and Wilcox Co., South Holland, Ill., 1956.

C. Periodicals
Automotive Service Digest
Motor Magazine
Consumers Report
Mechanix Illustrated

D. Movies
In addition to theory movies, several general interest and background films are included such as: *A Change for the Better* — G.M., *Our American Crossroads* — G.M., *A Thing of Beauty* — G.M.

E. Teaching Styles
This course accommodates a maximum of 15 students. The students work on cars under the guidance of second year auto shop students and the instructor. Brief demonstrations, using shop made models, are given preparatory to commencing work. Films demonstrating the operation of some of the sytems are shown. Selection of the topic to be covered depends on the interests of the class and the availability of a vehicle in need of specific work.

F. Evaluation
Pass-Fail grades are given based on attendance and active class participation. The second year student assistants receive credit for their participation.

PART III. DETAILED UNIT

MINOR TUNE UP JOB SHEET

I. Objectives
A. To learn how to test engine condition
B. To learn to interpret tests
C. To learn to make minor adjustments
D. To learn to service and replace parts

II. Procedure
A. Follow tune up guide and job sheet
B. Have proper specifications on job
C. Compression test of cylinders
   1. Blow dirt from plug wells; remove spark plugs; rack plugs in order
   2. Attach compression gauge; rotate engine with starter; read pressure at end of first pressure stroke and again at end of fourth stroke. Note pressure increase. Do all cylinders; mark up guide
   3. Squirt heavy oil into all cylinders; rotate engine to distribute oil; repeat compression test; note pressure increase above previous
   4. Do "Hiss" test. Attach air line to plug hole pressurize cylinder; rotate engine until valves are closed; listen at carburetor — hiss means leaky intake valve; listen at tail pipe — hiss means leaky exhaust valve; listen at radiator filler — bubbles mean leaky head gasket
D. Spark Plugs
   1. Examine plug for fouling or burning

2. Clean and gap plugs
3. Bomb for operation under pressure
4. *Do not install plugs until later*

E. Primary Circuit — Check wires for continuity, bad insulation and loose connections

F. Distributor
1. Remove cap, mark #1 wire; pull all wires
2. Clean cap and terminals — use brushes
3. Check cap for cracks
4. Remove rotor and check for burned contact
Note: Burned contacts in distributor or rotor may be caused by resistor type plugs or voltage regulator set too high
5. Check breaker point for burning or pitting — any fault means condenser
6. Twist cam shaft to check for lash
7. Check mechanical advance for looseness
8. Set advancer to 0° Adv.
Note: If new points are installed, lubricate fibre block with a squeak of grease; oil pivot with tiny dot of lube oil; install new condenser
9. Lube Breaker plate bearings with dot of oil
10. Gap Breaker points on #1 lobe of cam
11. Replace distributor cap

G. Secondary Circuit
1. Inspect plug wires for dryness and wear
2. Check terminals for tightness and corrosion
3. Replace wires in distributor (Follow firing order)
Be sure wires are firmly seated
4. Remove, clean and replace coil wire
5. Install plugs — *use new gaskets – torque*

H. Battery
1. Check voltage output
2. Check specific gravity
3. Check terminals for corrosion and tightness
4. Check cables for corrosion and wear
5. Clean hold down clamp with soda water

I. Charging System
1. Open generator and clean commutator
2. Check brushes for wear
3. Adjust fan belt tension
4. Tighten all connections
5. If regulator is not sealed, open cover and clean with carbon tet and cloth tape; do not disturb adjustments

J. Fuel System
1. Fuel pump test — disconnect outline wire; attach pressure gauge; disconnect primary coil wire; crank engine with starter; note fuel pressure — (pressure should remain constant for one minute after cranking has stopped); reconnect fuel line and wire; tighten fuel lines
2. Remove, clean, replace filter bowls
3. Crank engine and check for fuel leaks
4. Clean air cleaner, crankcase breather and crankcase vent filter; replace
5. Lube heat valve with penetrating oil

K. Safety Test — check as indicated on tune up guide

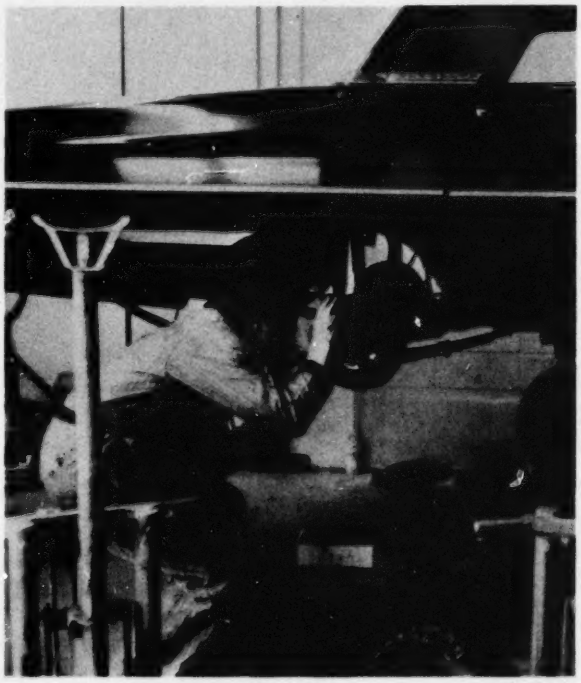
L. Complete tune-up according to guide instruction booklet

M. Combustion Test — as described in tester booklet

N. Complete all forms — tune up guide, service ticket, attention form

O. Clean up

P. Road test car if possible
Note: If desired, starter can be removed, cleaned and replaced; this is not part of regular tune up, but is usually desirable to improve winter starting.
Note: Valve adjustment is not usually a part of a minor tune up, but may be included if desired. Hydraulic lifters are never included.



BASIC ELECTRICITY

by Harry Carter

OBJECTIVES

This course deals with electricity as it affects the consumer and homeowner. It is a "hands on" course, with the students actually doing wiring and other related electrical operations. While avoiding involved technical theory, the fundamental principles and techniques covered constitute an appropriate introduction for students wishing to pursue careers in electricity. Students explore related occupations, visit job sites, learn proper use and care of necessary tools, and become better able to purchase and maintain electrical devices. They may pursue specific areas in depth. There are no prerequisites for enrollment.

PART I. COURSE OUTLINE

I. Introduction to Electricity
- A. Its flow as compared to the movement of water in pipes
- B. Differences between alternating and direct current

II. How to Wire a Doorbell
- A. How to mount the components
  1. Types of devices available
  2. Methods of fastening components; tools and their usage
- B. How to connect components
  1. Series and parallel circuits
  2. Mechanical connectors
  3. Soldering techniques
  4. Short and open circuits
  5. Types and sizes of wires and insulations
- C. How a switch works
  1. Types of switches
  2. Contacts and terminals
- D. How a buzzer works
  1. Electromagnets
  2. Transformers
  3. Solenoids and relays
- E. How a battery works
  1. Dry cell — wet cell
  2. Voltage and amperage
  3. Recharging
- F. How fuses work
  1. Purpose and function
  2. Rating for safety
  3. How to replace different types

III. The Doorbell as a Continuity Tester
- A. Definition of continuity
- B. How to wire leads
- C. How to test circuits, bulbs, batteries, etc.
- D. Safety precautions

IV. House Wiring

Utility boxes are mounted on a board by each student or student group, and devices are wired, inspected and tested with the previously made continuity testers. After being energized, each circuit is dismantled or modified to produce the next circuit listed.
- A. Light bulb in a porcelain socket
  1. How a light bulb works
  2. Types of sockets available
  3. Types and sizes of wires used
  4. Types of boxes and mounting devices
  5. Color codes of wires and screws
  6. Cable connectors
  7. Grounding requirements
  8. Wiring techniques
- B. Wall switch to control the light
  1. Types of switches available
  2. Types of boxes and mounting devices
  3. Wire connecting devices
  4. Color codes
  5. Covers — available and advisable
- C. Power from duplex to switch to light
  1. Types of receptacles available
  2. Parallel ground requirements
  3. Capacity of wires and branch circuits
- D. Split duplex wired with half on a switch and half on a constant power, continuing to the light through a switch
  1. Modification of receptacle
  2. Use of three wire cable
  3. Exceptions to color codes
- E. Power to three way switches then to light
  1. Internal functions of switch
  2. Use of three wire cable between switches
- F. Power to light then to three way switches to reinforce understanding

V. Wire a duplex, switch, and light circuit on a wall section covered on the face side
- A. Box mounting techniques
- B. Ringing out a circuit
- C. Application of all fundamentals

VI. How to wire a main fuse panel
- A. Types of breakers and disconnects
- B. How to size the fuses to the wires
- C. Types of wires and shields
- D. How to balance the load
- E. Where each wire connects
- F. Grounding
- G. Explain 110/220 three wire split
- H. Labeling and tagging
- I. Water heater and special circuits
- J. Review local codes

VII. Automotive Wiring
- A. Simple switching circuits are reviewed comparing switches and bulbs with house wiring
- B. Special circuits like the horn and starter

are covered stressing grounding and relays

C. Trouble shooting the ignition system
   1. Primary circuit
   2. Secondary circuit
   3. Induction and voltage changes
   4. Types of wires
   5. Function and maintenance of all components

D. Charging systems
   1. Alternators
   2. Generators
   3. Controls and regulators
   4. Battery capacity

VIII. Motors

A. Types of motors
B. How they work
C. How to clean a commutator and replace brushes
D. Testing and cleaning starting winding contacts on motors
E. Lubrication and bearing replacement
F. Overload protection devices

IX. Electronics

If time permits and there is student interest, work could be done in electronics using radio kits.

ORGANIZATION

Most electricity courses start out with the atom and progress through all the formulas which apply. While this is very logical, it can also be frightening and uninteresting. This course starts in the middle and works sideways. The students learn "How" to make things work and then go back and find out "Why" they work.

The students start by making a combination doorbell and continuity tester in the first week, finding out how the parts work as they go. Once completed it is used in conjunction with the rest of the course.

An approximate time table for two facets (14 weeks) at four mods per week (80 minutes)

3-5 weeks — construct tester
4-5 weeks — house wiring
1 week — motors
3-4 weeks — automotive electricity
1 week — electronics or formulas
1 week — field trip or film

PART II. RESOURCES

A. Texts

While there are no specific text books issued to each student, one particular reference book, *House Wiring*, by Floyd Mix is used a great deal. The "How to" booklets from Channel Lumber Company are also widely used and are specific enough to be used as job sheets.

Exploring Electricity, Rollain, Phillip I., and Kraus, Thomas E., Delmar Pub., Albany, N.Y., 1971.

Electricity & Electronics, Loper, Orla E. and Ahr, Arthur F., Delmar Pub., Albany, N.Y., 1968.

Industrial Arts Electricity, Lush, Clifford and Engle, Glenn E., Bennett Pub. Co., Peoria, Ill., 1965.

Home Electrician, Daniels, George, Popular Science, Harper & Row, New York, N.Y., 1964.

House Wiring, Mix, Floyd, Goodheart-Wilcox Co., Inc., South Holland, Ill., 1973.

Repairing Small Electrical Appliances, Hertzberg, Robert, Arco Pub. Co., Inc., New York, N.Y.

Electrical Repairs, Day, Richard, Arco Pub. Co., Inc., New York, N.Y., 1969.

How to Repair (Appliances), Campbell, Edward A., Arco Pub. Co., Inc., New York, N.Y., 1957.

Simplified Electrical Repairs, Drann, Donald R., Easi-Bild Pattern Co., Inc., Briarcliff Manor, N.Y., 1970.

Automotive Basic Electricity, Brandman, Monte L., McGraw Hill Book Co., New York, N.Y., 1971.

Complete set of *"How To"* Booklets (50), Channel Lumber Co., Inc., Whippany, N.J.

C. Tools and equipment

Small hand tools such as an assortment of screwdrivers, pliers, wire cutters, strippers, crimpers, a hammer and a soldering iron are required.

D. Most demonstration equipment can be found in local dumps and garage sales or obtained from friendly contractors. A demonstration model of an induction coil with a galvanometer and a St. Louis motor are helpful but not essential. Both of these items are available through science equipment supply houses or Paxton-Patterson Co., 45 Samworth Road, Clifton, N.J. 07012.

E. Materials for each student or student group are available from electrical contractors or supply houses. They are as follows:

1. For bell circuit
   1 ea. — bell-buzzer combination
   1 ea. — 10 V transformer
   2 ea. — bell buttons
   1 ea. — 2 x 4 utility box with cover
   5 ft. — bell wire or zip cord
   2 ft. — 14-2 nonmetallic cable
   1 ea. — handle caps with parallel ground
   1 ea. — cable connector
   2 ea. — wire nuts
   1 pc. — ½" plywood approx. 12" x 16"
2. For house wiring circuits
   1 ea. — 4" octagonal utility box
   3 ea. — 4" square utility box
   2 ea. — 4" utility covers — single switch
   1 ea. — 4" utility covers — single duplex

1 ea. — 4" porcelain socket
6 ea. — cable connectors
1 ea. — single pole switch
2 ea. — 3 way switches
1 ea. — duplex receptacle
10 ft. — 14-2 nonmetallic cable
4 ea. — screw lugs for grounding
1 ea. — ½" plywood approx. 16" by 24"

3. Automotive wiring — components available through auto salvage yard
   1 ea. — distributor
   2 ea. — spark plugs
   1 ea. — coil
   1 ea. — battery to activate all units
   1 ea. — secondary wire set
   2 ft. — primary wire
   1 ea. — ballast resistor
   1 ea. — ignition switch
   1 ea. — ½" plywood approx. 16" x 24"

F. Teaching Styles

Present facilities can accommodate ten to twelve students. Each student actually works with the equipment individually or in small groups. After receiving basic instruction via lectures and discussions, students learn "how" things work through joining wires and then find out "why." Complex technical formulas are avoided as much as possible. Students make a continuity tester and then use it to test other circuits that they wire.

G. Evaluation

Pass-Fail grades are given based on attendance and active participation. Students are expected to make a door bell continuity tester and to wire lights, switches, receptacles, etc.

H. Student Parameters

Students are expected to attend classes regularly and make up any absences. They are expected to cover most of the topics provided and may pursue special areas of interest in depth or on an independent basis.

PART III. DETAILED UNIT

Introduction

Topic IV — E & F — How to wire a light controlled by one of two switches where the power is applied to the farthermost switch.

(By the time the students reach this point, they have mastered most of the fundamental techniques of running wires, stripping, forming loops, connecting wires and grounding devices; the emphasis is on figuring out circuitry.)

I. The problem is presented to the students by asking them each to draw a circuit that would accomplish the stated goal.

A. Discuss different types of switches
   1. Single pole
   2. Three-way
   3. Four-way
   4. Mercury (stress position)
   5. Check contact position with tester
B. Dismantle and examine a three-way switch
C. Check drawings before beginning the wiring
D. Establish the function of the two "traveler" wires between switches

II. Students Select Appropriate Supplies

A. Two three-way switches
B. Two feet of 14/3 wire
C. Their boards with boxes and fixtures

III. Wire Components as per Drawings

A. Power from plug on cable to first 4" box
B. Secure 3 wire cable between switch boxes
C. Join all white wires in boxes (red and black of 3 wire cable are travelers)
D. Black wires from power and light connect to common legs of switches
E. Test circuit with bell tester

PART IV

A. Evaluation

Inspection of the completed work is sufficient to determine a student's proficiency and understanding.

B. Resources for unit on three way switches:

1. The most important resource is a supply of parts used to construct the circuit.
2. The doorbell continuity testers made by the students are used several times.
3. The "How to" booklets on three-way switches and the book "*House Wiring*" by Floyd Mix are especially useful.

JEWELRY MAKING AND LAPIDARY

Introduction

These courses combine two complementary areas and are team taught by two instructors. They enable students not only to design, shape and display their lapidary work, but also to enhance their jewelry designs. Students elect the entire program which is presented in one set of time periods. The teachers alternate their presentations, helping the students design and make jewelry, and cut, polish and set stones in their jewelry pieces. Techniques and processes stress a craft and hobby approach, with creative expression, instead of the use of industrial methods. Designs and procedures range from simple to complex, allowing students a wide range of choices. Many related objectives are stressed, such as the development of good and safe working habits, appreciation of natural resources and consumer awareness. Each course is described separately in the following outlines.

JEWELRY

by Frank Azzaro

OBJECTIVES

Jewelry is one of man's oldest art forms and means of creative expression. It began from early collections of bone, shells, and stone, and progressed with the discovery of metal. Jewelry reflects a culture's designs and values.

This course considers jewelry making as a handicraft, not as a manufacturing process. Emphasis is on individual creation and design in a variety of materials. Different metals are used as a vehicle to create these designs with special attention given to the plastic quality of the material; that is, its ability to be bent, stretched, forged, shaped, drawn, or cast into a finished article. The finished design is metal, or a combination of metal and stone.

Course objectives include helping the student develop the following:

1) Safe work habits with machinery and hand tools
2) A consumer awareness regarding manufactured articles
3) An interest in design and craftsmanship through individual project development
4) An interest in non-work related activities for leisure time use; to relate design and creative processes to individual projects; and to relate them to design and manufacturing in industry.

PART I. COURSE OUTLINE

I. Introduction
- A. Explanation of course direction and relation of course overview to the student
- B. Student's role as an active participant and decision-maker
- C. Safety
- D. Review of project plan
  1. Thumbnail sketch
  2. List of materials
  3. Cost estimation
     a. Linear measure
     b. Troy measure

II. Design of Projects
- A. Form related to function of article or project
- B. Simplicity in design
- C. Size and proportion of project
- D. Color
- E. Texture
- F. Thumbnail sketch

III. Introduction of Materials
- A. Metals
  1. Copper
  2. Brass
  3. Bronze
  4. Sterling silver
  5. Gold
- B. Cost of materials

IV. Tools
- A. Safety
- B. Cutting
  1. Saws
  2. Shears
  3. Cutting pliers
- C. Bending
  1. By hand
  2. With pliers
  3. Bending fixture
- D. Torches
  1. Description
     a. Buntam torch — propane and air
     b. Prestolite — acetylene and air
     c. Oxy-Acetylene — oxygen and acetylene
  2. Operation procedure
     a. Safety
     b. Efficient use
- E. Joining
  1. Soft solder
  2. Hard solder
  3. Mechanical fasteners
     a. Rivets
     b. Screws
     c. Nut and bolt combination
  4. Glue
- F. Finish
  1. Filing
  2. Grinding
  3. Polishing
     a. Tripoli
     b. Red rouge
  4. Florentine finish

5. Steel brush finish
6. Oxidation
7. Lacquered

V. **Casting**
- A. Cuttle fish
  1. Limited to simple design
  2. Convex surfaces
  3. Fair surface finish
- B. Wilkinson method
  1. Vacuum operated
  2. Limited production
- C. Centrifugal casting
  1. Lost wax process
  2. Investment molds
  3. Good surface finish

VI. **Stone Setting**
- A. Irregular stones
- B. Symmetric stones

PART II. RESOURCES & EVALUATION

A. Texts

Jewelry Making, Bovin, Murray. Bovin Publishers, Forest Hills, N.Y., 1967.

Creative Gold and Silversmithing, Choate, Sharr, Crown Publishers, Inc., New York, N.Y., 1966.

Contemporary Jewelry, Morton, Philip, Holt, Rinehart, Winston, Inc., New York, N.Y., 1970.

Design and Creation of Jewelry, Van Neumann, Robert, Chilton Book Co., New York, N.Y., 1970.

Handwrought Jewelry, Franke, Lois E., McKnight Pub., Chicago, Ill., 1962.

B. Organization

In order to have the class operate in the safest, most efficient, and most consistent manner, all students will receive basic instruction in large group form. Listed below are suggestions for studying most areas in this course. These are only suggestions, and their order and content can be changed to accommodate the students' individual differences.

1) All projects are selected by the student, based on his interest in a particular facet of jewelry making
2) The number of projects and their related sizes are determined by the student and instructor, based on time and ability
3) A thumbnail sketch must be submitted for all projects and designs
4) A student is expected to compute the cost of all stock to be used in the project
5) Choice of materials is made according to the needs of the design and student interest in the material
6) All projects must be completed before starting work in another area
7) Individuals are responsible for cleaning up their own particular work area and other areas which they might have used in working on projects
8) Major goals for the individual projects should be quality and craftsmanship
9) Trips to industry are possible when there is a direct relationship between the classroom process and the process used in industry
10) Individual instruction is carried out continuously during the course so that a student can progress at his own rate
11) Provisions are made for independent study for those students who wish to devote more time than regularly scheduled class hours

C. Teaching Styles

After consultation with their instructor, the students select, design and make their own pieces. Demonstrations are presented by the instructor or other students, along with individual instruction. This course can accommodate twenty students with two instructors. The class is evenly divided between the two areas, jewelry and lapidary. Students rotate halfway through the course. The group meets as one class, students observing one another and sharing ideas. Additional independent work is encouraged.

D. Evaluation

Students are responsible for all safety rules and procedures in the laboratory and receive written tests to demonstrate their knowledge. They have the option to choose their own grading system. Proper routines for the operation of equipment are reviewed individually before a student uses a particular machine. Individual evaluations are based on how closely the original design was followed and craftsmanship involved in a particular project as well as the neatness and accuracy of a student's work and its individuality.

LAPIDARY

by William Frazee

OBJECTIVES

The prime objective of this course is to develop an interest in stones through collecting, cutting, shaping and polishing. To achieve this objective, students study and perform various cabochon cuts and learn the different methods used in making them. Other objectives include the development of discriminating tastes in stone selection, the location and acquisition of materials, and the promoting of interest in natural resources.

Lapidary is "the art of cutting gems, the cutting, polishing or engraving of precious stones other than diamonds." Carved marble, polished granite and engraved limestone all have their places in the history of mankind, and nature has been generous in her endowment of rocks and minerals throughout the world.

This mini-course explores our country's resources of lead, copper, iron ore and related minerals; locates the primary sources of precious and semi-precious stones throughout the world; enables students to cut, polish, and, in conjunction with jewelry-making, mount and display their products, not as an industrial method, but completely as an avocation process.

PART I. COURSE OUTLINE

I. Sawing
- A. Types of saws
  1. Slabbing
  2. Trimming
- B. Sawing lubricants
  1. Water
  2. Soluble oil
- C. Preparatory steps to consider before the sawing operation
  1. Fastening the stone
  2. Checking the mineral for qualities of iridescence to determine direction of cut
  3. Checking the mineral for pattern and color combination before sawing
  4. Using adequate lubrication during sawing process
  5. Starting a diamond saw blade into the mineral without moving the blade out of its turning plane
- D. Selection of slabbed blanks
  1. Using the material to its best advantage
  2. Considering pattern and markings and using them to their best advantage
- E. Cutting a cabochon blank
  1. Outlining the desired shape on a slabbed piece
  2. Placing outlined slab on a work platform
  3. Placing the slab carefully into the trim saw in a straight line
  4. Making series of cuts close to the cabochon outline until a blank is cut out
- F. Types of cuts used in lapidary work
  1. Cabochon cuts
  2. Facet cuts
     a. Emerald cuts
     b. Brilliant cuts

II. Rough Grinding for Cabochon cuts
- A. Grinding operations and safety precautions
- B. Abrasives used in grinding
  1. Grit size 50 or 60 — used for very rough lapping or grinding
  2. Grit size 100 or 120 — used for rough grinding wheels or lapping
  3. Grit size 220 — used for fine grinding or lapping
  4. Grit size 400 — used for very fine grinding or fine lapping
  5. Final polishing on felt

III. Dopping (to dop a gem is to fix it to the end of a stick)
- A. Types of dop sticks
  1. Plain, round, hardwood of various diameters
  2. Dop stick lengths from 3½" to 5"
  3. Three different thicknesses or diameters used: ¼", ⅜", and ½"
- B. Tools for dopping
  1. Flame from a Bunsen burner or alcohol lamp
  2. Smooth block of wood or metal for rolling and cooling the cement
  3. Dopping sticks
  4. Tweezers and a cabochon
- C. Dopping cement
  1. Plain sealing wax
  2. Commercial dopping cements

IV. Finish Grinding
- A. Using a grinding wheel for delicate fragile materials like opal and turquoise
- B. Grinding with very light pressure
- C. The rocking motion used to obtain a smooth curved surface on a cabochon

V. Sanding
- A. Materials
  1. Silicon carbide cloth
  2. 320 grit
  3. 600 grit
- B. Sanding operation
  1. Fastening the gem stone to the dop stick and stroking it lightly across the sanding cloth
  2. Rotary motions used
  3. Using short strokes to avoid overheating the gem
  4. Dry or wet sanding
  5. Alternating dopped gems to prevent overheating

VI. Polishing
- A. Types of polishing wheels
  1. Wooden wheels for first polish
  2. Felt wheels for high luster
  3. Leather wheels for high luster
- B. Polishing agents
  1. Tripoli
  2. Tin oxide
  3. Cerium oxide
  4. Lavigated alumina
  5. Jeweler's rouge
- C. Preparation of the polishing agent
  1. Making a thin paste or cream with plain water
  2. Avoiding contaminating with other grits

D. Application
   1. Applying the polishing agent to the wheel
   2. Keeping the polishing wheel well moistened with the polishing agent

E. Polishing operations
   1. Washing the stone thoroughly
   2. Washing the hands thoroughly
   3. Moistening the wheel with polishing agent
   4. Keeping the dopped gem constantly in motion back and forth across the wheel, rotating it rapidly so it does not become overheated
   5. Testing the stone frequently until a lustrous finish appears

VII. Undopping and Cleaning

(After the gem has been polished to a high luster, the next step is to remove the stone from the dop stick and clean it, without marring the finish or damaging it)

A. Undopping operation
   1. Dipping the gem into chilling water (after a few minutes, the stone will dop off the stick)
   2. Warming the stone gently over an alcohol lamp to about 100°F, then slipping a thin-edged blade around the base, pressing the soft cement away from the back of the gem

B. Cleaning — removing the cement (place the gem into ordinary grain alcohol or methyl alcohol for about 10 or 20 minutes, then wipe it dry with a clean cloth)

VIII. Safety

A. General safety rules
   1. Avoiding loose clothing
   2. Wearing safety goggles
   3. Using tweezers for picking up slabs
   4. Washing hands thoroughly after working with each new operation
   5. Making equipment secure and level
   6. Keeping machines lubricated
   7. Periodically inspecting tools and equipment
   8. Operating all wheels at recommended speeds
   9. When starting, allowing wheels to run free for one minute; when finished, draining water and running dry
   10. Avoiding touching the edges of the wheel when it is in motion

IX. Specific Safety

A. Sawing
   1. Never running a saw dry — keep well lubricated
   2. Securing the blade to the arbor
   3. Never forcing a blade
   4. Clamping all work securely
   5. Operating at recommended speeds
   6. Not forcing rough material against the saw (chips may fly and the stone may be damaged)

B. Rough grinding
   1. Making sure the wheel is either all wet or all dry before starting
   2. Standing to one side when starting the grinder (a wheel wet on one side will be unbalanced and may explode when starting)
   3. Making sure the arbor is not too tight for the job, nor the wheel too heavy for the arbor
   4. Always operating with wheel guards in place
   5. Operating wheel at recommended speeds

C. Dopping
   1. Being careful of hot molten cement on hands
   2. Not touching hot cement except with wet hands or tweezers
   3. Keeping alcohol torch for heating cement in a safe location

D. Finish grinding
   1. Keeping fingers away from abrasive wheel
   2. Making sure the wheel is not running dry
   3. Operating at recommended speeds

E. Polishing
   1. Keeping all polishing wheels covered to prevent contamination
   2. Operating at recommended speeds

PART II. RESOURCES AND EVALUATION

A. Lapidary Stations

The room should be set up in as many separate stations as equipment and space will allow. Each station of operation is devoted to one area of stone cutting and polishing. The student should feel free to rotate from station to station, according to ability, interest and progress. At each station, the student should encounter the materials, tools, visual aids and safety procedures related to that state of the lapidary arts.

The more common stations are:

1. Slabbing the rough material
2. Designing and trimming the slab
3. Dopping (procedure follows)
4. Grinding and sanding
5. Polishing and mounting
6. Tumbling stones
7. Designing and mounting stones
8. Cutting facets and engraving

B. Dopping Station

The dopping station (3) is an area equipped with an alcohol stove, a Bunsen burner or an electric hot dop heater, various sizes of dopping sticks, e.g. ¼" dis., ½" dia., etc., *Green Devil* dopping wax, tweezers and a spatula. Students who complete the work in stations 1 and 2, in groups of two or three familiarize themselves with the equipment. By asking questions, the instructor encourages the students to develop the procedures necessary to connect the dopping sticks firmly to the backs of stones. The instructor then reviews the following procedure:

1. Heating the end of the dop stick and warming the stone
2. Dipping it into hot but not molten wax
3. Rolling a portion of the wax on the dop stick to the shape of a cone; using a spatula or moistened fingers
4. Patting a small flat on the top of cone to accept the stone
5. Warming the stone to hold the stick and wax
6. Rolling the wax on the dopping stick like "cotton candy," transferring it to the warm wax and sticking it to the warm stone; smoothing the wax around the stick and stone.

The evaluation of the student's progress in this station depends on the dopping stick being at a proper angle to the stone and a fillet of wax being spread evenly around this stock. The progress of the student at this station is further noted in later stations when the pressure of grinding is applied to the stone at right angles to the dopping stick.

The safety procedures to be observed in this area include:

1. Keeping the flame away from the fingers and away from other individuals
2. Making sure fingers and/or spatula are wet before attempting to form around the "cobo" or stones

C. Teaching Styles

After consultation with their instructor, the students select, design and make their own pieces. Demonstrations are presented by the instructor or other students, along with individual instruction. This course can accommodate twenty students with two instructors. The class is evenly divided between the two areas, jewelry and lapidary. Students rotate half way through the course.

D. Evaluation

A Pass-Fail grade is awarded, based primarily on attendance, participation and accomplishment in accordance with ability. Self-evaluation is continuous, since each operation depends on correctly completing previous operations.

Rumson-Fair Haven Regional High School

Ridge Road
Rumson, New Jersey 07760

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For further information contact: Mr. Newton Beron, Project Director
Rumson-Fair Haven Regional High School
Ridge Road, Rumson, New Jersey 07760
(201) 842-1597

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